

RESEARCH ARTICLE

Analgesic Effect of Chayote (*Sechium edule* (Jacq.) Swartz) Ethanol Extract on Heat-Induced Pain in Mice (*Mus musculus*)

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ABSTRACT

Background: Pain is a sensation that indicates that the body is experiencing tissue damage, inflammation, or more severe disorders such as nervous system dysfunction. Pain often causes discomfort such as stabbing, burning, electric shocks, and others that interfere with the quality of life of patients or people experiencing pain. Analgesics act as drugs used to reduce or eliminate pain or pain relievers without losing consciousness. Indonesia is famous for its diversity of plants, especially agricultural products and spices. One of the subtropical plants that are often found in Indonesia is the chayote plant (*Sechium edule* (Jacq) Swartz). where the plant can be used as an alternative medicine for analgesics.**Objective:** The purpose of this study is to determine the analgesic effect of ethanol extract of chayote (*Sechium edule* (Jacq) Sw) on mice against heat pain.

Methods: This research is an experimental laboratory study with a posttest only controlled group design on male white mice. Mice were divided into 6 groups, namely the normal group, the negative control group, the positive control group and the group given ethanol extract of chayote with a dose of 50 mg/kgBW, 100 mg/kgBW, and 150 mg/kgBW. Mice were acclimatized for 14 days first, then a hot plate test was carried out to induce pain. After the mice experienced pain, they were given ethanol extract of chayote. Analgesic activity was assessed at 30, 60, 90, and 120 minutes.

Results: The results of the analgesic activity of giving ethanol extract of chayote given to mice had an analgesic activity value of 7.4 ± 0.55 in the group given a dose of 100 mg/kgBW of ethanol extract of chayote where this result was the best result among the other 3 dose variants. The results of % good analgesic activity was also found in the group given 100 mg/kgBW of ethanol extract of chayote with a value of 30% compared to other groups.

Conclusion: Ethanol extract of chayote 100 mg/kgBW has better analgesic activity and % analgesic activity in mice compared to other treatment groups.

Keywords: Chayote, Analgesic, Hot Plate, Analgesic Activity, % Analgesic Activity

INTRODUCTION

Pain is a sensation indicating that the body is experiencing tissue damage, irritation, or more severe disorders such as neurological impairment. Consequently, pain is frequently referred to as a warning signal to protect the body from further tissue damage. It often causes discomfort—such as cutting, burning, or throbbing sensations—that diminishes the quality of life for individuals suffering from chronic or acute pain.¹

Analgesics are medications used to eliminate or reduce pain without causing a loss of consciousness. Analgesics are classified into two categories: opioid (narcotic) analgesics and non-narcotic analgesics. Opioid analgesics are a group of drugs with properties similar to opium or morphine. These medications are used to alleviate or eliminate severe pain, such as in post-operative recovery or cancer. Examples include Methadone, Fentanyl, and Codeine. Non-narcotic analgesics are frequently known in pharmacology as peripheral analgesics, consisting of non-narcotic drugs that do not act centrally on the nervous system.^{2,3}

Lidocaine is a commonly used local anesthetic belonging to the amino-amide class. In clinical practice, lidocaine can be administered in various forms (e.g., liquids, eye drops, creams) through diverse administration routes (e.g., epidural, subarachnoid, intrapleural, intravenous, intramuscular, intra-articular, and topical).⁴

Paracetamol is a non-narcotic analgesic that works by inhibiting prostaglandin synthesis, primarily within the Central Nervous System (CNS). This analgesic is a compound that, at therapeutic doses, alleviates or suppresses pain without possessing general anesthetic properties.⁵

Indonesia is renowned for its vast biodiversity, particularly in agricultural products and spices. This is supported by Indonesia's geographical conditions, characterized by a tropical climate and high annual rainfall. One of the subtropical plants widely found in Indonesia is Chayote (*Sechium edule* (Jacq.) Swartz), whose fruit is utilized as a nutritional ingredient and is commonly consumed as a vegetable.⁶

One plant that can be utilized as an alternative analgesic is the Chayote fruit (*Sechium edule* (Jacq.) Swartz). Chayote contains flavonoid compounds that possess analgesic, anti-inflammatory, anti-hyperglycemic, anti-apoptotic, and antioxidant effects.⁷

METHOD

Research Methodology

Sample Distribution

In this study, 30 mice were divided into 6 groups:

1. Group 1 (Normal): Mice received no treatment.
2. Group 2 (Negative Control): Mice were administered 0.5% CMC.
3. Group 3 (Positive Control): Mice were administered Paracetamol at a dose of 1.82 mg/20 g BW.
4. Group 4: Mice were administered Chayote ethanol extract at a dose of 50 mg/kg BW.
5. Group 5: Mice were administered Chayote ethanol extract at a dose of 100 mg/kg BW.
6. Group 6: Mice were administered Chayote ethanol extract at a dose of 150 mg/kg BW.

Preparation of Chayote (*Sechium edule*) Ethanol Extract

Fifteen kilograms of Chayote were stored in a dry place, thoroughly washed under running water, and sliced to a thickness of 6–7 mm without removing the skin. The slices were then dried in an oven set at 55°C. Following the drying process, the moisture content of the *simplicia* was measured. The *simplicia* was then ground using a blender and sieved through a 40-mesh screen. The ethanol extract was prepared using the maceration method by soaking 700 g of dried *simplicia* powder in 5,250 mL of 96% ethanol for 3 days. The maceration was kept in a place protected from direct sunlight and stirred occasionally to obtain Macerate I. The residue was then re-extracted with 1,750 mL of 96%

ethanol, sealed for 2 days, and filtered to obtain Macerate II. Macerate I and II were combined and allowed to settle overnight. The extract was subsequently concentrated using a vacuum rotary evaporator at 60°C.

Sample Adaptation

Mice were acclimatized in the Animal House for 14 days with adequate food and water. The cages were filled with wood shavings to ensure the comfort of the mice throughout the research process.

Administration of Chayote Ethanol Extract

The Chayote ethanol extract was administered orally at doses of 50 mg/kg BW, 100 mg/kg BW, and 150 mg/kg BW using a gastric gavage needle (*sonde*).

Hot Plate Test

The Hot Plate method involves placing the test animals on a hot plate heated to a specific temperature. The animals respond by jumping, licking their paws, or shaking their paws. This test is suitable for identifying the activity of analgesics. The procedure involves observing the frequency of jumping, paw licking, and paw shaking in the experimental groups compared to the positive control (medications with proven analgesic effects) and the negative control (placebo). A reduction in the frequency of jumping, licking, and shaking movements in the test animals indicates the compound's analgesic efficacy and its ability to increase the pain threshold.⁸

RESULTS

Table 1. Analgesic Activity of Chayote Ethanol Extract in Mice Using the Hot Plate Method

Perlakuan Terhadap Hewan Uji	Respon atau reaksi Mencit Terhadap Panas (Menit)					Nilai p
	30 Menit	60 Menit	90 Menit	120 Menit	$\bar{x} \pm SD$	
K1 (Normal)	5 ± 0,71	5,2 ± 0,84	3,6 ± 0,55	3,4 ± 1,14	4,3 ± 0,93	<0,001*
K2 (Negatif)	5,8 ± 1,3	4,0 ± 0,71	3,8 ± 0,84	4,2 ± 0,84	4,5 ± 0,91	
K3 (Positif)	8,0 ± 1,58	9,4 ± 1,82	7,6 ± 0,89	7,8 ± 0,45	8,2 ± 0,82	
K4 (EELS 50 mg/kgBB)	6,4 ± 0,55	6,0 ± 1,87	5,4 ± 1,14	5,4 ± 1,52	5,8 ± 0,49	
K5 (EELS 100 mg/kgBB)	7,4 ± 0,55	7,2 ± 1,48	5,8 ± 0,84	6,0 ± 1,00	6,6 ± 0,82	
K6 (EELS 150 mg/kgBB)	8,0 ± 1,22	7,6 ± 1,14	6,0 ± 1,22	5,8 ± 0,84	6,9 ± 1,11	

Based on Table 1, the analgesic activity testing using the hot plate method revealed variations in response latency, with the maximum response observed at the 30-minute and 60-minute intervals. The group exhibiting the highest response was Group 3 (Positive Control/Paracetamol) at the 60-minute mark, with a mean latency of 9.4±1.82 seconds. Among the treatment groups, the maximum response was observed in Group 6 (Chayote Ethanol Extract 150 mg/kg BW) at the 30-minute mark, with a mean latency of 8.0±1.22 seconds."

DISCUSSION

The results of the analgesic activity test using the hot plate method revealed that the ethanol extract of Chayote, administered to mice at a dose of 150 mg/kg BW (Group K6), yielded the highest analgesic value among the treatment groups, with a mean latency of 8.0±1.22 seconds. This outperformed the other two dosage variants: 6.4±0.55 seconds in Group K4 (50 mg/kg BW) and 7.4±0.55 seconds in Group K5 (100 mg/kg BW). The maximum response for the extract was observed at the 30-minute mark, indicating that Chayote possesses significant analgesic properties. However, superior analgesic activity was observed in Group K3 (the positive control group administered Paracetamol), which reached a maximum response at the 60-minute mark with a value of 9.4±1.82 seconds.

According to a study by Alquadah et al. (2023) involving hot plate tests on mice, flavonoids have been proven to exert antinociceptive effects through various physiological pathways in both the peripheral and central nervous systems. This, in turn, reduces the production of pain mediators, including prostaglandins. The hot plate test is a specific method used to evaluate the supraspinal and spinal biological properties of new drugs while excluding input from peripheral nociceptive neurons. Flavonoids increase the latency period before mice perceive discomfort in the hot plate test, suggesting that their antinociceptive activity is centrally

mediated. Furthermore, flavonoids can inhibit glutamate-induced pain responses, potentially regulating pain transmission mediated by the glutamatergic system. This effect may be attributed to the interaction between flavonoids and glutamate receptors or their ability to block the release of nitric oxide, which is known to play a crucial role in pain signaling.⁹

Behavioral responses such as paw licking and jumping in mice are considered to be supraspinally integrated. Therefore, an extract that inhibits these behaviors in the hot plate method suggests that the extract acts at the supraspinal level. The findings of this study indicate that the ethanol extract prolongs reaction time in the hot plate test, which may reflect a higher sensitivity of supraspinally mediated reflex responses within this experimental model.¹⁰

CONCLUSION

"The ethanol extract of Chayote (*Sechium edule*) exhibits a significant analgesic effect in mice. Among the treatment groups, the dose of 150 mg/kg BW demonstrated the most potent analgesic activity compared to the other extract dosages (50 mg/kg BW and 100 mg/kg BW). However, the analgesic efficacy observed via the hot plate method was not as superior as that provided by the positive control, Paracetamol."

RECOMMENDATIONS

"Further research is required to evaluate the administration of Chayote ethanol extract using a broader range of dosages and extended observation periods to determine its long-term efficacy and safety profile."

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